What is claimed is:

1. A method of planarizing a wafer surface containing:

an interlayer dielectric having an upper surface and a plurality of spaced apart openings;

a barrier layer lining the opening and on the upper surface of the interlayer dielectric; and

copper (Cu) or a Cu alloy filling the openings and on the interlayer dielectric;

the method comprising the sequential steps of:

(a) chemical mechanical polishing (CMP) the wafer reduce the Cu or Cu alloy layer at a first removal rate to a thickness of about 500Å to about 3,000Å; and

(b) CMP the wafer to remove the Cu or Cu alloy layer at a second removal rate, less than the first removal rate, stopping on the barrier layer.

2. The method according to claim 1, further comprising buffing to remove the barrier layer and form the dense array of Cu or Cu alloy features having a size of at least about 0.1 micron.

3. The method according to claim 1, comprising:

conducting step (a) at the first removal rate greater than about 5,000Å per minute; and

conducting step (b) at the second removal rate of about 1,000Å to about 3,000Å per minute.

4. The method according to claim 1, wherein:

the interlayer dielectric comprises a silicon oxide; and

the barrier layer comprises tantalum (Ta) or tantalum nitride (TaN).

5. The method according to claim 2, comprising conducting steps (a) and (b) at a selectivity of Cu:Ta greater than about 100.

6. The method according to claim 5, comprising conducting step (b) under conditions such that dishing within the dense array is no greater than about 300Å.

7. The method according to claim 6, comprising conducting steps (a) and (b) on a rotating or linear fixed abrasive polishing pad mounted on first and second platens, respectively, using an abrasive-free chemical agent.

8. The method according to claim 7, comprising controlling dishing in the dense array during steps (a) and (b) by rotating the first and second platens, respectively, at less than about 60 rpm or linearly moving the first and second belts, respectively at less than about 30 inches per second, to control the polishing pad or belt temperature at no greater than about 50°C.

9. The method according to claim 7, comprising CMP a plurality of wafers and cleaning the polishing pads by removing debris and CMP by-products between each wafer.

10. The method according to claim 7, comprising controlling the removal of polishing by-products during steps (a) and (b) by flowing the chemical agent across the wafer at a flow rate of at least about 300 milliliters per minute onto the first platform.

11. The method according to claim 7, comprising recycling the chemical agent.

12. The method according to claim 7, comprising controlling the removal of particles during steps (a) and (b) by controlling the static etching rate up to about 150Å per minute by controlling the amount of inhibitor in the chemical agent.

13. The method according to claim 7, comprising flowing an inhibitor across the wafer surface after completing step (a) and prior to initiating step (b) to prevent undue static etching.

14. The method according to claim 2, comprising flowing an inhibitor across the wafer surface after completing step (b) and prior to initiating buffing to prevent static etching.

15. The method according to claim 2, comprising:

controlling dishing in the dense array during steps (a) and (b) by:

conducting steps (a) and (b) on first and second platens, respectively, rotating at less than about 60 rpm or on linearly moving first and second belts at about 30 inches per second, to reduce the polishing pad temperature to no greater than about 50°C;

controlling the removal of particles during steps (a) and (b) by:

flowing the chemical agent across the wafer surface at a flow rate of at least about 300 milliliters per minute and/or

controlling the static etching rate to about 100 to about 150Å per minute by controlling the amount of inhibitor in the chemical agent;

flowing an inhibitor across the wafer surface after completing step (a) and prior to initiating step (b) to prevent static etching; and

flowing an inhibitor across the wafer surface after completing step (b) to prevent static etching; and

recirculating the chemical agent.

16. A computer-readable medium bearing instructions for planarizing a wafer surface, said wafer surface containing an interlayer dielectric having an upper surface and a plurality of spaced apart openings; a barrier layer lining the opening and on the upper surface of the interlayer dielectric; and copper (Cu) or a Cu alloy filling the openings and on the interlayer dielectric, said instructions arranged, when executed by one or more processors, to cause the one or more

processors to control a chemical mechanical system (CMP) to perform the steps of:

(a) chemical mechanical polishing (CMP) the wafer to reduce the Cu or Cu alloy layer at a first removal rate to a thickness of about 500Å to about 3,000Å; and

(b) CMP the wafer to remove the Cu or Cu alloy at a second removal rate, less than the first removal rate, stopping on the barrier layer.

17. The computer-readable medium of claim 16, wherein said instructions are further arranged for buffing to remove the barrier layer and form the dense array of Cu or Cu alloy features having a size of at least about 0.1 micron.

18. The computer-readable medium of claim 16, wherein said instructions are arranged for:

conducting step (a) at the first removal rate greater than about 5,000Å per minute; and

conducting step (b) at the second removal rate of about 1,000 to about 3,000Å per minute.

19. The computer-readable medium of method claim 17, wherein said instructions are arranged for conducting steps (a) and (b) at a selectivity of Cu:Ta greater than about 100.

20. The computer-readable medium of claim 19, wherein said instructions are arranged for conducting

step (b) under conditions such that dishing within the dense array is no greater than about 300Å.

21. The computer-readable medium of claim 20, wherein said instructions are arranged for conducting steps (a) and (b) on a rotating or linear fixed abrasive polishing pad mounted on first and second platens, respectively, using an abrasive-free chemical agent.

22. The computer-readable medium of claim 21, wherein said instructions are arranged for controlling dishing in the dense array during steps (a) and (b) by rotating the first and second platens, respectively, at less than about 60 rpm or linearly moving the first and second belts, respectively, at less than about 30 inches per second, to control the polishing pad or belt temperature at no greater than about 50°C.

23. The computer-readable medium of claim 21, wherein said instructions are arranged for CMP a plurality of wafers and cleaning the polishing pads by removing debris and CMP by-products between each wafer.

24. The computer-readable medium of claim 21, wherein said instructions are arranged for controlling the removal of polishing by-products during steps (a) and (b) by flowing the chemical agent across the wafer at a flow rate of at least about 300 milliliters per minute onto the first platform.

25. The computer-readable medium of claim 21, wherein said instructions are arranged for recycling the chemical agent.

26. The computer-readable medium of claim 21, wherein said instructions are arranged for controlling the removal of particles during steps (a) and (b) by controlling the static etching rate up to about 150° per minute by controlling the amount of inhibitor in the chemical agent.

27. The computer-readable medium of claim 21, wherein said instructions are arranged for flowing an inhibitor across the wafer surface after completing step (a) and prior to initiating step (b) to prevent undue static etching.

28. The computer-readable medium of claim 17, wherein said instructions are arranged for flowing an inhibitor across the wafer surface after completing step (b) and prior to initiating buffing to prevent static etching.

29. The computer-readable medium of claim 17, wherein said instructions are arranged for:

controlling dishing in the dense array during steps (a) and (b) by:

conducting steps (a) and (b) on first and second platens, respectively, rotating at less than about 60 rpm or on linearly moving the first and second belts

about 30 inches per second, to reduce the polishing pad temperature to no greater than about 50°C;

controlling the removal of particles during steps (a) and (b) by:

flowing the chemical agent across the wafer surface at a flow rate of at least about 300 milliliters per minute and/or

controlling the static etching rate to about 150Å per minute by controlling the amount of inhibitor in the chemical agent;

flowing an inhibitor across the wafer surface after completing step (a) and prior to initiating step (b) to prevent static etching; and

flowing an inhibitor across the wafer surface after completing step (b) to prevent static etching; and

recirculating the chemical agent.

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